

National Aeronautics and Space Administration

Office of Space Science

SPACE SCIENCE ADVISORY COMMITTEE

December 5-6, 2001

Cocoa Beach, FL

MEETING REPORT

Marc S. Allen
Executive Secretary

Steven W. Squyres
Chair

**SPACE SCIENCE ADVISORY COMMITTEE (SScAC)
Cocoa Beach, FL
December 5-6, 2001**

**MEETING MINUTES
TABLE OF CONTENTS**

Welcome and Chair's Remarks	2
Associate Administrator's Report	2
Division Reports	3
Mars Exploration Program	4
In-Space Propulsion	5
Technology Program Reports	5
Mars Discussion	7
Subcommittee Reports:	
Origins Subcommittee	8
Sun Earth Connections Advisory Subcommittee	9
Solar System Exploration Subcommittee	9
Structure and Evolution of the Universe	10
Committee Discussion	10
Associate Administrator's Comments	12
Strategic Plan Update	13
IT Security Update	14
GPRA Performance Assessment	15
Closing Remarks	17
Appendix A	Agenda
Appendix B	Committee Membership
Appendix C	Meeting Attendees
Appendix D	Recommendations
Appendix E	List of Presentation Material

***Meeting Report Prepared By:
Paula Burnett Frankel and
Mark Schroepe, Consultants,
RS Information Systems, Inc.***

SPACE SCIENCE ADVISORY COMMITTEE (SScAC) MEETING
Cocoa Beach, Florida
December 5-6, 2001

Wednesday, December 5

Welcome and Chair's Remarks

Dr. Steven Squyres, Chair of the SScAC, called the meeting to order and welcomed members and attendees. He noted that this would be his last meeting as Chair of the Committee. Drs. Bruce Margon, Richard Mewaldt, Molly Macauley, Douglas Richstone, and William Smith will also be rotating off of the SScAC; new members are Drs. Roderick Heelis, Kristen Sellgren, and Paul Knappenberger. Dr. Andrew Christensen will be the next chair of SScAC. Dr. Edward Kolb will replace Dr. Margon as the next Chair of the Structure and Evolution of the Universe Subcommittee (SEUS). After introductions, Dr. Squyres briefly reviewed how the SScAC and the advisory process works. He recommended that the abridged versions of the Committee's letters continue to be prepared and made available.

Associate Administrator's Report

Dr. Edward Weiler, Associate Administrator of the Office of Space Science (OSS) noted some major highlights since the last meeting: launch and orbital insertion of the 2001 Mars Odyssey and the Hubble Space Telescope (HST) discovery of an atmosphere on an extra-solar planet. Dr. Ed Weiler summarized the OSS FY 2002 Appropriation. The President's Request was \$2,786,362. The bill was signed on November 26, 2001 for \$ 2,848,937. The increase was provided to fund a number of earmarks. The propulsion research laboratory at MSFC was a partially unfunded earmark that resulted in a \$13 million net "damage" to the OSS budget for in-space propulsion technology. In addition, the bill contained policy direction on the Europa Orbiter mission, Next Generation Space Telescope (NGST), and Mars. NGST was funded at the requested level. Mars was fully funded. NASA received the OMB and budget passback for FY 2003-2007 on November 26, 2001; however, the content is embargoed until the President formally releases the budget request to Congress in January or early February. There are 7 space science launches scheduled over the next 12 months. There is a large concern about the future of small launch vehicles. Dr. Weiler reviewed the SScAC recommendations from the last meeting and noted that most of these would be the subject of presentations at this meeting.

All of the themes have been successful and have had good press reports this year. In response to a question, Dr. Weiler noted that NASA has been going through a Strategic Resources Review (SRR) to examine how to solve the resources problems (primarily Space Station) within the Agency. Taking funds from Space Science or Earth Science was never discussed. The events of September 11 will affect NASA. However, it will not change the way that OSS does business (unless directed by the Administration). Space science will follow the charter of the Space Act. Dr. Weiler said he doubted OSS would be redirected toward safety and security priorities. Unfortunately, we are producing fewer scientists and engineers every year. Space Science can act as an inspiration and do a better job in education and outreach. Dr. Squyres noted that one of the recommendations in the Young report was for a two year period to restructure the Space Station program, focus on top priorities (science and long term human space flight), and get it on track. After two years, program augmentation (e.g., expansion of crew capability) could be considered if the program is on track. Dr. Weiler emphasized how important it is for NASA investigators to engage in education and outreach.

Dr. Riegler gave the SScAC an update on the Space Operations Management Office (SOMO) and the Consolidated Space Operations Contract (CSOC) status. In the future, the CSOC will be managed by OSS for OSS missions. Day to day management will be deferred to the appropriate center. Investigators will have "freedom of choice" in operations—they can use CSOC or whatever operations approach is most cost effective. OSS went to some length to deal with the funding issues in May/June this year, and further cost overruns are not anticipated. One outstanding issue is the long-term health of the Deep Space Network (DSN). Dr. Weiler noted that many OSS missions were extended well beyond their prime phase, and this contributed to the SOMO funding problem. The current policy is that future mission budgets must include funding for data analysis and operations. Dr. Squyres noted that the issue of who controls the elements of CSOC relevant to OSS has been a battle for three years; it appears that OSS has won it.

Division Reports

Dr. George Withbroe reported on the Sun-Earth Connections (SEC) theme and the Explorer Program, which is managed within the SEC Division. He highlighted a recent image from the Solar and Heliospheric Observatory (SOHO) that showed imaging beneath sunspot activity via helioseismology. Gas flows confirm a theory on why sunspots are stable. Living With a Star (LWS) is the intersection of science, space weather, and global climate change. There are a series of Solar Terrestrial Probes (STP), starting with the Thermosphere-Ionosphere-Mesosphere Energetics and Dynamics (TIMED) mission, which is scheduled to launch this month. The LWS Research Network consists of the Solar Dynamics Observatory (SDO), Solar Sentinels, and Geospace missions. The University Explorer (UNEX) and Explorer technology initiatives are on hold. The current cost cap guidelines for all active missions and future missions is \$180 million for Mid-class Explorers (MIDEX) and \$85 million for Small Explorers (SMEX). SMEX 8 and 9 are in Phase A studies; downselect is scheduled for July 2002. This continues to be a very rich scientific program. Forty-three proposals were received in the last MIDEX solicitation. Selection will be in May 2002 with downselect around January 2003. Dr. Beichman raised an issue from the Origins Subcommittee (OS) meeting: Is there a way to have a larger cost cap category (\$300 million) for Explorers? Dr. Weiler noted that the issue of more expensive Explorers is a topic for the SScAC. This is a good time to start the discussion on whether it is more desirable to have larger Explorers. Another difficult subject is in-house spacecraft versus out-of-house spacecraft. More and more spacecraft are built by industry and fewer and fewer are built by the Jet Propulsion Laboratory (JPL) and the Goddard Space Flight Center (GSFC). Currently, there is an OSS policy that in order to maintain scientific and engineering competence, JPL and GSFC must have at least one OSS spacecraft being built in-house at any time. This provides a source of expertise and assistance for less privileged universities that need help from those capabilities. JPL provides a unique capability in planetary science. There has been a discussion at the SRR on the role of scientists at the centers. They are there primarily to enable science by outside scientists. Dr. Squyres noted that the SScAC failed to reach a consensus on the in-house/out-of-house issue at the last meeting; however, he indicated that the Committee would take up the question again.

Dr. Colleen Hartman reported on the Exploration of the Solar System (ESS) theme. She highlighted some key recent results from the currently planetary science missions—Near Earth Asteroid Rendezvous (NEAR), Galileo, Cassini, and Deep Space (DS)-1. Stardust and Genesis have been launched and are on their way for scientific exploration. The FY02 appropriation permits the Europa Orbiter (EO) mission to be sole-sourced intramurally (to JPL) and capped at \$1 billion. The current runout is \$1.22 billion. Congress also provided \$30 million for the Pluto Kuiper Belt (PKB) mission and did not transfer Telecommunications and Mission Operations Directorate (TMOD) funds at JPL to CSOC as proposed by the Senate. Dr. Hartman summarized recent events related to PKB. Even if all outer planet funds in FY03 were used solely for the PKB mission, OSS is still \$100 million short in FY03. At a recent National Research Council (NRC) meeting, OMB representatives presented three options for the outer planets program: adopt the PKB mission in the FY03 budget and indefinitely delay EO and future missions; ignore the PKB mission (Congress would indefinitely delay EO and future missions); or redirect EO and future mission funds to better-justified programs within or outside NASA. OMB suggested the third option was most likely. Dr. Hartman stated that the planetary program would be devastated under any of these options. The Solar System Exploration Subcommittee (SSES) had discussed this issue. What is needed is an integrated campaign of multiple missions of varying costs for the solar system. OMB has made it clear that it will be very difficult to sell anything that is \$1 billion or more. The campaign needs to begin with a prioritized list of science requirements. The decadal report will be released in the spring and this will provide important support. The Discovery Program has been very successful. Dr. Hartman showed the Discovery missions in the FY02 President's budget. The next Discovery selection should be announced very soon. The X2000 technology program is now rolled into the EO line. It will be very useful for EO and Mars missions. Dr. Hartman briefly reviewed the in-space propulsion program, but Dr. Squyres deferred discussion on this topic until later in the meeting. As noted earlier by Dr. Weiler, OSS received a \$13 million earmark that impacted the budget for the in-space propulsion program. The remaining budget is \$19.6 million. The plan is to fund only high priority technology development and systems analysis—a next generation ion engine, aerocapture, solar sails, and Nuclear Electric Propulsion (NEP).

Dr. Kinney reported on the Astronomical Search for Origins (ASO) and Structure and Evolution of the Universe (SEU) themes as well as the Astronomy and Physics (A&P) Division. A great team is in place to work on roadmapping and strategic planning. A&P is highly motivated to work on the NGST issues, e.g., the international complexities. The major missions in the two themes are envisioned to have a strong international element. Dr. Kinney described two new working groups in A&P and provided an update on the National Virtual Observatory (NVO). The new OSS organization is working very well. The Division continues to be organized along the two themes, although there are a number of program scientists and program executives that work in both areas. The Division is creating a new Science Archives Working Group (SAWG) to focus on data archival issues. The other working group is the Astronomy and Physics Working Group (APWG), which will replace the Astrophysics Working Group. Each will have a Chair and Deputy; one will serve on OS and one will serve on SEUS. The NVO came out of a recommendation by the NRC decadal survey committee. The Division endorses the concept, but recognizes that NASA is unlikely to get a new start initiative with SMEX-level funding. The NVO initiative must be built out of the ongoing program. The core of NVO already exists within the astrophysics data archive program, the data and computing technology program, and the data analysis research program. The three principal components of NVO are: the data content, the data mining and exploration tools, and the grants program using NVO for research. Dr. Squyres observed that given the current OSS structure, unless there is a special aspect that requires attention at a higher level, topics limited to the ASO and SEU themes do not need to be elevated to the SScAC, but can be considered at the subcommittee (SEUS and OS) level.

Mars Exploration Program

Mr. Orlando Figueroa discussed program status and advisory committee actions. The near term technical progress is proceeding according to the baseline program plan. The liens against the FY02 President's budget are expected to require changes to the baseline mission schedule. Next decade science and technology needs attention over the next six months. The foremost program priority is mission success. The second is preserving the mission strategy and balancing the resources. The third is international contributions. The fourth is broadening the scientific community, including Scout. Mr. Figueroa reviewed each of the program missions. Selections for Mars Exploration Rovers (MER) participating scientists are planned by April 2002. The Mars Scout Announcement of Opportunity (AO) is in development using the Discovery Model. The NASA Research Announcement (NRA) for the Mars fundamental research program is in final development and will be issued as part of the Research Opportunities in Space Science (ROSS) NRA in 2002. The intent is to bring this budget to 1% in 2003 and 1.5% in 2004. The Mars Instrument Development Program (MIDP) NRA is expected to be released in early 2002. The Mars Smart Lander (MSL) AO development will begin in 2002 after mission definition. The second mission extension for Mars Global Surveyor (MGS) has been approved. Great results are still being published. As noted earlier, Mars Odyssey orbit insertion was achieved successfully. Early images have been taken. The science from the mapping orbit will commence in early February. The MER mission has completed its critical design phase and is making excellent technical progress. However, significant risk areas have been identified by the Independent Review Team (IRT). JPL is positioned to deliver at least one rover without compromising technical or scientific integrity. The project will stay on course with further assessment at two further gates in December and January. Mr. Figueroa noted that relative to the IRT's areas of assessment, the MER project has a general overall "yellow" rating. With respect to the budget reserves, the project has a "red" rating. MER is and will remain a high risk mission. In response to a question, Mr. Figueroa further discussed three risk areas: mass margin, schedule, and ATLO flow. There are two end-member implementation paths to meet the objectives of the MSL mission—a mobile geo-biology explorer and the multidisciplinary program. Six-month, industry studies of sample return technical approaches have been completed. The estimated cost of the mission ranges from \$1.5 billion to \$2.5 billion. Variables included the number of landers, the degree of international participation, and the means of sample return to Earth. We need to find a way to make sample return more affordable. Mr. Figueroa provided an overview of plans for returned sample handling. There is now a draft of the protocol for returned sample handling. The biggest driver on the schedule is the quarantine facility.

Mr. Figueroa described what the program is doing in terms of independent review. The Mars Exploration Review Team (MERT) will be a "high level" team that will provide program level assessment to the Mars Exploration Program (MEP) Director annually. Rather than form another advisory subcommittee, the SSES will have members that will represent Mars exploration. MER, MRO, and Scouts each have IRTs.

One of the chairs will be selected to consolidate common systemic issues and report to the MEP. Dr. Squyres noted that the SScAC had recommended a science group who was available to the MEP manager and scientist on an as-needed basis to provide science advice. This is the Mars Exploration Program Analysis Group (MEPAG). It also recommended a high level group that would include scientists, technologists, and experienced program analysts to advise on overall programmatic issues. The MERT is intended to respond to this recommendation. The SSES needs to maintain a tight coupling with MEPAG and MERT.

In-Space Propulsion (ISP)

Dr. Hartman provided an overview on the ISP Initiative. The objective is to develop in-space propulsion technologies that can benefit near and mid-term NASA science missions. Technology areas include electric propulsion, propellantless propulsion, and advanced chemical propulsion. The approach will be to identify and prioritize the most promising technologies using systems analysis and peer review. Over the past year, eleven proposed example missions in eight propulsion categories were assessed. Dr. Hartman described one of the assessments as an example—a NEP (nuclear electric propulsion) option to Neptune/Triton. High priority technologies include: aerocapture; next generation ion thruster; NEP; and solar sails. Aerocapture provides significant benefits in trip times and payload mass fraction to many mission designs. NEP enables entire classes of missions not otherwise possible or feasible with reasonable trip times. Potential high-risk/high payoff endeavors include: plasma sails; momentum transfer tethers; bimodal nuclear thermal rockets, and solar thermal propulsion.

The Next Generation Ion Propulsion NRA has been released. The FY02 ISP Technologies NRA will be released in January; the FY03 ISP Technologies will be released in March. The ISP mission level requirements were provided by a multidisciplinary team.

Dr. Squyres noted that the SScAC went on record last time strongly supporting a robust in-space technology program. It must adequately address the needs of all users across the Space Science Enterprise. There is a lot of interest in this technology in SEC and ESS. Dr. McComas indicated that the Sun-Earth Connection Advisory Subcommittee (SECAS) is very happy with the structure for the ISP initiative and the fact that solar sails had regained some priority.

Technology Program Reports

Each of the Division Directors and the MEP Director presented his or her views on the OSS Technology Program. Dr. Kinney briefly described the technology resources and where they are contained in OSS. Most of the technology lives in focused technology programs (\$307 million). These are low and mid Technology Readiness Level (TRL) activities. Research and Analysis (R&A) Programs also contain resources for low, mid, and high TRL technologies. The future Mars programs include technology resources (all TRLs) for future missions. Two other OSS programs that are entirely technology are Core Technology (cross-divisional, all TRLs) and the New Millennium Program (mid and high TRL). There are also NASA resources outside OSS.

Dr. Withbroe discussed the New Millennium Program (NMP) and other technology programs within SEC. The objectives are to identify and validate breakthrough technologies and mitigate risks to first users. It focuses on technology needs at mid-TRL maturity level. Space Technology (ST)-5 was confirmed last week. It will test our ability to fly a science-based spacecraft constellation as precursor to a number of constellation missions in SEC and Earth Science. Three technologies have been selected for Phase B formulation for ST-6: low power avionics sensor suite; autonomous rendezvous; and autonomous sciencecraft constellation operations. Dr. Squyres indicated that the SScAC was interested in how the specific technologies are tied to the roadmap missions. Dr. Kinney and Dr. Withbroe commented that the NMP Program Office works specifically with the theme technologists, who are key players in the roadmapping activity. Four systems are under consideration for ST-7: solar sail; aero-entry/capture; disturbance reduction system; and autonomy. Down-selection to a single concept for Phase B is planned for January 2002. Dr. Withbroe noted some of the technology areas in the R&A program. There is another technology program under LWS, Space Environment Testbeds, to study effects of solar variability on instrumentation.

Dr. Kinney discussed the A&P resources that contain technology. Most of the technology is within the Focused Technology Program. The second source is the R&A Program; about half goes to technology development and the other half goes to basic research. Dr. Kinney described the progression in the R&A program from 1995 to today. In 2003, there will be one suite of technology programs and one suite of basic research programs. The A&P Supporting Research and Technology Program includes: suborbital, detectors, supporting technology, laboratory astrophysics, ground-based, and fundamental physics. Dr. Kinney described the A&P Division development process and cited the Large Telescope Systems Initiative (LTSI) as an unsuccessful example (LTSI did not get funded this year). She also cited Terrestrial Planet Finder (TPF) as a successful example, now in development.

Mr. Figueroa discussed the Mars Technology Program. The overarching technology goals are to enable new classes of Mars science investigations, increase payload mass fraction delivered to Mars, develop precise payload landing, enable access to the subsurface, surface, and atmospheric regions, enable long-lived surface science investigations, and support high data return from Mars. There are two classes of technology: focused (enabling specific missions, e.g., Smart Lander and Sample Return) and multi-mission. Technology requirements are defined by Lead Center (JPL) and approved by NASA Headquarters. Dr. Squyres flagged the concern regarding technology requirements definition for Scouts as an issue for further discussion. Multi-mission technologies (low and mid-TRL) are 100% competed. In response to a comment, Mr. Figueroa indicated that NRAs for multi-mission technologies will be released in the future. Focused technologies (mid-TRL) are obtained through multiple vehicles ranging from sole source (if justifiable) to full and open competition. Technology investments are reviewed annually for progress, continued relevance, and compliance with policy. Mr. Figueroa described the technology flow for a number of product areas. For each of the key technology areas, the project identifies the current capability and the target capability that is needed. There are some technology needs that are not being addressed at the present time: radioisotope power systems (RPS) technologies; technology development infrastructure; low-power, low-mass electronics; advanced flight computers; robotic manipulation, etc. An area where improvement is needed is defining technology/capabilities to enable new concepts for next generation missions. The Scouts fall into this area. In response to a question regarding in-house/out-of-house work, Mr. Figueroa indicated that NASA is paying attention to some core capabilities that need to be maintained at JPL for the Mars Program.

Dr. Hartman discussed technology for solar system exploration. The challenges are distance, environmental extremes, and exploration of complex, interactive systems. Currently, there is no significant technology funding in ESS. However, Dr. Hartman described the integrated technology planning process that will be used after the NRC decadal report is released. One example was Europa Orbiter. Even without an exact mission suite, the Division can take a look at the types of missions it might have and the preliminary capability needs for these hypothetical missions. For example, power generation will be a key technology need. The focused technology in Europa Orbiter is the avionics package (X2000). Other users are interested in the X2000 package as well. The Division has convened an external Technology Assessment Group to assist the development of the Integrated Technology Plan for solar system exploration. The Group is a mixture of scientists and engineers. The expected output is assessment of an overall technology strategy, evaluation of priorities, and assessment of the technology infusion strategy. This Group will feed into the SSES. There are technology dollars in the R&A instrument development programs, and there have been significant accomplishments to date.

Dr. Hartman summarized the technology issues across OSS: balancing between long-term, low-TRL investments and near-term, immediate needs; “controlling” programs outside of OSS control; predicting cost and schedule for far-future technologies; obtaining funds for flight validation; and determining an appropriate mix of ambitious, currently unfunded programs and associated technologies and decadal investment strategies. Dr. Squyres noted that the SScAC Chair needs to talk to the NASA Advisory Council (NAC) about the issue of cross-enterprise oversight of technology.

Dr. Harley Thronson addressed the coordination of OSS advanced technology. The OSS Technology Director coordinates cross-Divisional evaluations of relevancy and “gaps” and mission concept analyses, as well as new technology initiatives for OSS. Dr. Thronson showed the SScAC a selected version of the OSS Technology “Blueprint.” This documents the technology required by the Enterprise, available

resources within OSS and elsewhere, mission requirements, and both met and unmet needs. In addition, Code R (the Office of Aerospace Technology) maintains an extensive source of information on technology programs throughout the Agency. One of the activities currently underway is a relevance assessment of the Code R Information Technology/Information Systems Program to OSS long-range missions. Other initiatives for the Technology Director are: a strategic review of rockets, balloons, detectors, and sensors, and evaluation of OSS's management of flight software. Dr. Squyres noted that flight software is a problem area at NASA, and flagged this as an item of considerable interest. SScAC should continue to pay close attention to this issue. Dr. Thronson plans to work with the Division Directors to identify areas of key technologies for future (15+ years) mission concepts. Significant resources exist in other Enterprises, particularly Code R. Code R and Code S need to do a better job in working together to support long-range goals. Dr. Beichman stated that this should be a major issue for the NAC and the new Administrator. There is an opportunity to demonstrate closer coordination between the two organizations. An example is Code R's new program: Pioneering Revolutionary Technology (PRT). The total FY02 budget is about \$254 million; about \$100 million is potentially useful to OSS. OSS is working closely with Code R to evaluate the program. Attractive potential features are under discussion, e.g., use of Enterprise requirements to prioritize technology investment, co-funding and co-management of technologies relevant to OSS, and mission analysis to identify technology requirements. Over the next two months, OSS will be coordinating a series of videocons and workshops with Code R personnel to recommend priority funding and develop a program plan that will formalize OSS participation in PRT. Very significant space technology investment is undertaken outside of NASA, and taking advantage of this activity might be very useful in achieving OSS goals. A Senior Technologist has been hired to evaluate and to seek opportunities for coordination with other agencies.

Mars Discussion

Dr. Squyres stated that while the Mars Program has a challenging schedule through 2006, he feels Mr. Figueroa is doing all the right things, and so he felt there was little need for discussion of that timeframe. Instead, he suggested that the SScAC focus on 2007 and asked if anyone present had issues with items earlier in the schedule they wished to discuss. Responding to a question regarding a fallback position on MER, Mr. Figueroa referred to his earlier explanation of the importance of launching both rovers and why there would be no benefit in dropping one now. However, he added that MER has several prescribed gates it must pass through including mass, schedule, and others, and that cancellations and/or delays will be reconsidered if the mission cannot pass through them. Dr. Squyres agreed that there are various escape paths depending on when and how the mission might go "off the rails," and that he feels Mr. Figueroa has all the information he needs to choose the proper one if serious problems do occur. Dr. Squyres further stated that he feels MER is being well scrutinized. Responding to concerns expressed by Dr. McComas regarding how MER decisions will be made, Mr. Figueroa clarified that there are specific metrics for MER that, if not met, would lead to a cancellation or delay. Dr. Squyres relinquished the gavel to Dr. Drake because of his (Squyres) leadership role in the MER project. The first one is likely to be mass, and if the mass budget is not met then an appropriate response will be determined. Others are schedule and cost. Dr. McComas stated his concern that the hardest decisions need to be made soon. Dr. Drake said that the SSES was comfortable with the explanation of the issue it heard and discussed during its meeting and that while the issue is complex, he believes Mr. Figueroa is correct in maintaining flexibility. Mr. Figueroa stated that there will likely be many necessary uncomfortable discussions regarding MER including dealing with landing site concerns.

Dr. Squyres resumed the gavel and turned the discussion to the program from 2007 on, noting that at the last meeting Mr. Figueroa outlined the specific priorities that would guide planning for this timeframe. Since that time Dr. Squyres has developed concerns with those priorities, noting for instance that the number one priority of preserving the science is interpreted differently by different people. Dr. Drake stated that the current program is based on returning samples in a meaningful timeframe. Though the budget embargo prevented full discussion of the issue, Dr. Drake felt that if Mars Sample Return (MSR) were pushed too far in the future, this priority and the plan for Mars exploration would have to be reassessed. The current \$2.5 billion estimate will most likely increase, making MSR particularly vulnerable, he said. Dr. Papike stated that he would like the number one priority to be getting ready for sample return in 2011. If an attempt cannot be made by then, continuation of the Mars Program past 2005 should be reassessed because there would not be a large enough incremental increase in benefits from non-

sample return missions. In that scenario, the focus might best be shifted to Europa and PKB. Dr. Squyres noted that in situ science cannot compare to the results that would be obtained studying returned samples, a point reinforced by various members. The members agreed, however, that SScAC was not the appropriate group to set science priorities for Mars, and that the issue should instead be handled in subcommittees such as SSES. Dr. Squyres felt that the SScAC could still make a valuable contribution by pointing out to Dr. Weiler and the NASA Administrator areas, such as the content-rich and challenging post-2007 schedule, where it expects trouble on the horizon. This was done at the last meeting and can be done again. Mr. Figueroa stated that having the community divided on Mars priorities is negatively impacting the program. Dr. Beichman said that the post-2007 schedule appears as if it will establish a perpetual panic mode and that plans should be one year farther along already. Dr. Papike suggested competing a 2011 Sample Return Mission (SRM) with a \$1.5 billion cap. There may be no credible proposals produced, but the world or at least the nation should have the chance to try. Mr. Figueroa noted that he was not sure SScAC could make such a recommendation. Making the mission affordable is a priority. Referring to concerns that the post-2005 schedule involves a great deal of risky science all at once, Dr. Sellgren asked if it might be advisable to try similar missions on the moon on a smaller scale to test them. Mr. Figueroa and Dr. Squyres noted that this had already been accomplished to some degree, i.e., Russian moon sample return in the 1970s. Dr. Drake observed that it could make sense to run some kind of autosampling on the moon as a demonstration. In summary, Dr. Squyres stated that the committee is deeply concerned about the credibility of the program after 2005 barring the unlikely event that the budget situation changes dramatically.

Dr. Squyres applauded Mr. Figueroa for setting up and working closely with the MEPAG and the MERT. Referring to earlier statements by Mr. Figueroa, he expressed concern that the Mars community is in fact dividing into two groups: those who think sample return can be done soon, and those who think it will be in the distant future. Definition of the MSL mission will be a critical factor, because it can either be a direct path to sample return, or it can send the program in a separate direction. Mr. Figueroa is going to have to choose between the two. A path needs to be defined with input from MEPAG, but SScAC cannot recommend one. In response to a question, Mr. Figueroa stated that advice from several groups might be needed to make the decision if opinions are split. Dr. Papike stated that MEPAG will not be divided because those most in favor of sample return have left the group in frustration. Dr. Drake noted that he does not think MEPAG will drive missions in such a way as to move them away from sample return. Dr. Richstone said he thinks the Mars Program is on a path to a 2007 disaster and that the committee's recommendation ought to be that an AO for sample return be released in the next six months. Dr. Drake stated that MSL cannot be defined until long-term priorities have been better established and that the issue cannot be properly discussed until the 2003 budget is released. Dr. Squyres asked if Mr. Figueroa was receiving the necessary advice from SSES. Dr. Drake answered that SSES has not provided this advice because SSES was not sure if an additional subcommittee was going to form; however, SSES can address the issue at the next meeting in March. In closing, Dr. Squyres restated that SScAC's responsibility is to make sure Mr. Figueroa has the advice he needs. He charged Dr. Drake with the duty of ensuring (prior to the next SScAC meeting) that between MEPAG, the Committee on Planetary and Lunar Exploration (COMPLEX), and SSES he is in fact receiving the necessary advice.

Committee members were assigned to write summaries of specific points from the day's discussions.

Thursday, December 6

Dr. Squyres explained that the day's Government Performance and Results Act (GPRA) discussion would be delayed until after the Subcommittee reports and a teleconference with Dr. Ed Weiler.

Origins Subcommittee (OS) Report

Dr. Alan Dressler reported on the OS meeting held earlier this week. He first outlined the status of OS programs. The Keck Interferometer is yellow because it is having problems with vibrations. The Full-sky Astrometric Mapping Explorer (FAME) is red because it is projected to go over its \$180 million budget and is in danger of cancellation. The Space Infrared Telescope Facility's (SIRTF's) launch has been delayed because of problems with flight software and this will result in additional cost. The Space Interferometry Mission (SIM) is making good progress on reaching technology milestones. Selection of a prime

contractor for the Next Generation Space Telescope (NGST) is underway. The OS spent a lot of time dealing with its roadmap. It is an excellent starting point, but supporting activities and smaller missions are ripe for more thorough review and Research and Analysis (R&A) is inadequately addressed. The APWG and the SAWG should be of great benefit to OS. They will be asked to review issues related to the Stratospheric Observatory for Infrared Astronomy (SOFIA). OS identified two issues on which it needs additional information: 1) Instrumentation for SOFIA and whether it meets Origins science goals; and 2) SOFIA's data cycle and whether the program is taking full advantage of already developed data reduction and archiving tools. In general, SOFIA is well into recovery from previous problems. The final servicing mission for HST is scheduled for 2004. Some science capacity will likely be lost between then and 2010, when the present plan calls for return of HST in the shuttle for placement in the National Air and Space Museum. One alternative is a 2007 servicing mission, which would greatly increase the chances of continued operation until 2010 and could be used to attach a propulsion unit in order to end the telescope's life by deorbiting it into the ocean. The feasibility or cost of such a mission is still unknown. Dr. Squyres stated that the issue is important, but not one that could be dealt with at this meeting. Dr. McComas noted that he would like to hear from museum representatives what the value of having HST would be. Dr. Dressler stated that there would be substantial value in placing it in the museum to inspire observers. Dr. Margon suggested that SScAC request a presentation on alternatives and Dr. Squyres felt that the issue was one that SScAC should in fact weigh in on. Dr. Richstone noted that while it is important to keep the highly productive HST group working, spending additional money to keep it operating would take away from the shift toward funding NGST. Dr. Dressler added that Dr. Weiler seemed to feel that money budgeted for a 2010 retrieval mission could not simply be moved forward to fund a 2007 mission.

Sun-Earth Connection Advisory Subcommittee (SECAS) Report

Dr. David McComas reported on the SECAS meeting held earlier in the week. SEC programs have enjoyed outstanding progress across the board with no lost spacecraft. Determining what to do with limited money for Mission Operations and Data Analysis (MO&DA) money has been difficult. A review of all missions beyond their prime phase resulted in hard decisions to turn off the Interplanetary Monitoring Platform-8 (IMP-8) and to put Wind into backup mode in case there is a problem with the Advanced Composition Explorer (ACE). All spacecraft development was rated green. Since the last meeting a large report on Living With a Star (LWS) was received from the Science Architecture Team (SAT). One concern was whether the LWS plan was sufficiently mature. In general, LWS looks pretty good and the first mission, the Solar Dynamics Observatory (SDO), is in good shape. SECAS is requesting temporary formation of a Theory and Modeling Team and a Data Systems Team, both of which should only be needed for about a year. Without them a problem might arise where a mission goes up and produces a big pile of data that is not used in the most effective way. Dr. McComas thanked SScAC for strong support of LWS in its recent letter. The community went to Congress and got \$3 million back for Solar Probe after the President cut it. It is critical to begin working on a real LWS mission instead of a possible mission with no defined payload; therefore, SECAS recommended that mission proposal selections be made even though funding is limited. Obviously, if Congress does not continue funding, the proposals would be dead. SECAS had a good joint session with SSES. The Subcommittee spent significant time discussing solar sails. It reviewed missions enabled by solar sails, a list that includes about one third of those in the SEC roadmap. Solar sails are critical for SECAS and the next logical step for enabling several planned missions. Solar sail technology would allow a spacecraft to sit in an interesting region and study it in great detail, an advancement Dr. McComas compared to the move from planetary flybys to orbiters. Solar sails are one of the technologies proposed for Space Technology-7 (ST-7) and SECAS feels there is a need to do a rapid demonstration of them.

Solar System Exploration Subcommittee

Dr. Michael Drake reported on the SSES meeting held earlier in the week. The meeting was less substantial than previous ones because the budget embargo limited discussions. An important recent event was the transfer of the TMOD to Code S, which is important because critical spacecraft maneuvers begin in 2003. The cost will be about \$400 million over five years, which is going to be taxed out of users in rough proportion to their usage. The full implications are impossible to understand because of the budget embargo, but it was definitely the right thing to do. A Deep Space Systems line was established for the first time, which is a major breakthrough even though there is not enough money for even one mission. The cost of MSR will probably be at the higher end of the estimates. This issue of when or whether a MSR

mission can be done will be addressed at the next SSES meeting in February. If it can be done in a reasonable time then the current Mars exploration strategy should be continued and the MSL should be defined based on MSR. Discovery was funded for 2002 but there will likely be slips because of TMOD. To compensate, at least part of a cycle may be delayed. SSES spent significant time discussing the roadmap. Realistically, there are not going to be any \$1 billion plus missions. What this means for Europa is not clear, but SSES will encourage JPL to think about how to do important Europa science without going beyond that level. Europa science objectives cannot be met with a flyby, a possibility considered by the Tiger Team. The question is whether it is worth doing a Level 1 mission for \$1 billion or whether there is something else that could be done with Europa for less that would be viewed by Congress and the community as a high priority. There is considerable concern that the Europa Orbiter is not going to fly.

Dr. Colleen Hartman looked at 2006-2007 and what it could look like with the projected budget. Excluding Mars, if carried out to 12 years, the funding level could enable a schedule with six Discovery missions, three mid-sized missions (Discovery Plus), and two major missions around \$800 million. The resulting competition should help maintain core capabilities in planetary, primarily at JPL. Responding to a question from Dr. Papike, Dr. Drake stated that Discovery is still just planetary, but it is broadly defined. He said it is important not to define or compartmentalize programs too tightly because that can lead to loss of good ideas. As part of its roadmapping activity, SSES convened Inner Solar System and Outer Solar System Task Forces. Written material for the roadmap is expected by January. The working title is "Evolution of a Habitable Planet." Material produced should be quite consistent with the NRC decadal survey underway. Mars is a special case in roadmapping and was not discussed in detail because plans after 2005 are not clear. There is a plan for that timeframe but it could slip. Congress has required a report on post-2007 plans. MEPAG will provide the initial input for this, which will be completed by SSES. Dr. Squyres asked for a summary of the relationship between MEPAG and SSES. Dr. Drake responded that the MEPAG chair would probably report to SSES on the group's activities. The primary technology issues are ISP and power. Someone from Education and Public Outreach (E/PO) will be appointed to SSES soon. E/PO will not be addressed for the roadmap until that happens. A near-term challenge is that Mars, Europa and Discovery do not make a balanced program. Areas with possible life cannot be the only focus. Also, OMB and Congress are currently at odds over the Pluto mission. Dr. Papike asked if it would be appropriate to have an under \$400 million mission go back to the moon to take south pole samples and to test equipment and hardware for Mars. Dr. Drake answered that the Inner Solar System Task Force will be addressing this issue. There is some question as to whether it is sensible to use the moon as a testbed for Mars. On the other hand, there may be things surface operations could test.

Structure and Evolution of the Universe Subcommittee (SEUS) Report

Dr. Bruce Margon reported on the SEUS meeting earlier in the week. Ninety-five percent of the SEUS meeting was dedicated to roadmapping preparation. For roadmapping there will be a special team made up of half SEUS members and half others from the community. SEUS will have approval over the document they produce. For the new roadmap, two goals will be to narrow the theme somewhat and to make the mid-term missions list shorter. The last roadmap had three missions listed high and three missions listed very high, but many felt that was too many. Shortening will be difficult because the missions cover a large range of science types, so different constituencies support each and they are all very good missions. A call is out for white papers to be part of the roadmapping process. SEUS heard presentations on various missions. Constellation-X (Con-X) and the Laser Interferometer Space Antenna (LISA) were rated so favorably in the last astrophysics decadal survey that they will be highlighted in the new roadmap. Some missions not seen favorably in the last strategic plan came back this time with much better missions, making SEUS members feel their time had not been wasted. SEUS had a joint meeting with OS to make sure their roadmapping activities are coordinated. The roadmap should say that very high-energy cosmic ray science is important. There were no disagreements over color classifications for GPRA items. SEUS heard a presentation on the NVO. Dr. Squyres noted that a number of people on the committee were initially uncomfortable with having two different advisory committees, OS and SEUS, for one Division Director. However, having sat in on parts of the OS and SEUS meetings and their joint meeting, he observed that the system seemed to be working impressively well.

Committee Discussion

The SScAC discussed core competency and Code S technology.

Core Competency Discussion:

The first issue raised by Dr. Squyres was the recommendation from Dr. Ed Weiler that a minimum set number of missions be kept "in-house" instead of competing them in order to maintain center core competencies. There was a lengthy discussion of this at the last meeting but no consensus was achieved, so SScAC was asked to take up the issue again. Dr. Squyres stated that his observation had been that what really matters is not the number of missions but the number of capable engineers supported, which amounts to how much money is being spent there. Dr. Papike indicated that his opinion has changed and he now supports the recommendation of Dr. Weiler. Dr. Hathaway noted that he still has a problem with the issue. If GSFC and JPL can't compete with the rest of the world to win the right to do these missions that means they are either overpriced or behind on technology. Therefore NASA would be either paying more than it needs to or paying for technology that is behind the curve. He noted that he would be surprised if the centers could not compete given that government employees are often paid less than commercial employees. Dr. Akin wanted to know more specifically how core competency would be defined due to a concern that simply voting yes would be giving JPL and GSFC "blank checks" to support the teams they have now without making tough decisions. Dr. Heelis expressed his support for Dr. Weiler's plan for maintaining core competency. Dr. McComas noted two arguments in the debate. One is that the centers have unique technologies and capabilities that are important to maintain that may not necessarily be needed by industry. Another is that there is a need for knowledgeable people to handle contracts. He accepts the first argument though he noted that it should be easy to compete if a center is the best at something. However, he felt the second argument was not strong and that it is a terrible time to support something that even appears to be an entitlement. Dr. Drake agreed with Dr. McComas' assessment, particularly the entitlement concern, though he noted that the core competency issue is important. Dr. Drake suggested that the SScAC could resolve to support Dr. Weiler by encouraging the administration to maintain core competency by whatever means necessary, though he noted this would be a weaker finding than full support of Dr. Weiler's plan. Dr. Papike characterized JPL and GSFC as national treasures and stated that core competency should be supported as an investment and not viewed as an entitlement. As a university Principal Investigator (PI) working with JPL on a big in-house mission, Dr. Squyres observed that JPL does have some unique capabilities in navigation, deep space avionics, robotics and other areas that enable missions that would otherwise not be possible, and he completely supported Dr. Weiler's stance on the issue. He stated that the issue is more than just a matter of keeping a certain number of engineers on the payroll or having enough dollars flowing into the centers. It is important that people keep getting paid but they have to continue to have missions that exercise those unique capabilities, which otherwise will cease to exist. He stated his personal opinion that core competency needs to be strongly supported, at least at JPL. He indicated that he was less familiar with GSFC and so not able to comment as much on that center. Dr. Mewaldt echoed the need for continually challenging the engineers. Dr. Hathaway restated his impression that if these Centers are the only ones with certain capabilities they should win in competitions and that he feared not making them compete would have a cost. Dr. Macauley added that if there were not a mission to support them for a number of years, engineers would come back with their talents intact, or young people would rise to the occasion. She requested that more information about the costs involved in maintaining core competency be provided, noting that the term needs better definition and could change over time. Dr. Squyres said that if especially challenging missions such as the Europa Orbiter were openly competed, then NASA would no longer be able to spend technology money to try to solve expected problems such as radiation because that would give an unfair advantage to centers. It could not continue with such work until a mission became official, which would delay progress. Dr. McComas noted that GSFC is an excellent center but that he is unaware of any truly unique capabilities there. Therefore, considering it with JPL could be a mistake. He suggested that a series of briefings on the issue may be needed, though he recognized the need to move forward. He supported Dr. Drake's suggestion of offering generic support, which Dr. Squyres agreed might be the closest thing to a consensus that could be achieved. Dr. Heelis observed that the issue extends beyond core capability, because maintaining unique capabilities at centers ensures that smaller universities and institutions have access to them. Dr. Papike agreed with Dr. Squyres assessments. Dr. Macauley felt that high-risk R&D is properly the role of government and expressed concern with the idea that competition could slow such work. Dr. Mewaldt noted that JPL and GSFC are regularly competing for missions.

Dr. Squyres observed that the whole committee appeared to agree on three things: (1) that it is necessary to maintain core competency, especially in unique areas; (2) that JPL and GSFC are national treasures; and (3) that core competency is no good unless skills are continually available to the OSS community. Nonetheless, he noted there appeared to be no consensus on giving a blanket endorsement to Dr. Weiler's plan. Dr. McComas was asked to write a summary of the committee's stance.

Code S Technology Discussion:

Dr. Squyres asked if the previous day's technology presentations gave insight into the current situation and if so, what suggestions or recommendations the committee could make. Dr. Akin said the presentations gave him the impression that technology is done autonomously with no coordination between Divisions and Enterprises and insufficient coordination with other agencies and industry. He expressed concern that a series of local sub-optimal decisions are being made on technology development and stated that NASA should fix the problem. Dr. Macauley felt the technology program seemed cobbled together. Dr. Richstone noted that good work was being done in each individual program but said there appeared to be a lack of coordination at the top of OSS and asked if OSS research is really state of the art. He observed that there is a strong need for an outside review of NASA's technology program so that experts can identify technologies where NASA can have an important impact. Dr. McComas agreed and noted that he was disappointed to find at the end of the briefings that no one had given a sufficient explanation of where the money goes.

Dr. Squyres summarized saying that overall, the presentations were good and he was impressed with each Director's grasp of work in his or her Division. There is no question OSS is developing a lot of good technology, and a substantial fraction of the work is openly competed. A more coherent explanation of how OSS money is being spent is needed. Dr. Squyres agreed with Dr. Akin's assessment and that there did not appear to be cross-division coordination or cross-Enterprise coordination, and little cross-agency coordination. Finally, he noted that there did not seem to be a clear explanation of how choices about what technologies to push forward are being made in relation to the Strategic Plan, which he characterized as a significant shortcoming. Dr. Drake noted that in some areas such as ISP there is coordination and so the committee should be careful not to reprimand the wrong people. Dr. Squyres suggested that SScAC's opinion could point to such positive work as the kind of coordination it is encouraging. All members agreed they would like to hear a presentation from Code R on its coordination with OSS.

Associate Administrator's Comments

Dr. Ed Weiler joined the meeting by telecon. Dr. Squyres reviewed issues raised during the meeting.

First, on the subject of in-space propulsion, there was strong support on the SScAC, which especially liked the SEC theme being included in the discussion process (solar sail).

Second, Dr. Squyres asked if there was a need for SScAC to advise on Hubble end-of-life issues. Dr. Weiler responded that there is a nearly infinite number of options and that he would be willing to listen to any that involve a 2010 end of mission and no significant money out of NGST. He noted that there are elements within the community, however, who would like to rationalize keeping Hubble up beyond that point. Dr. Weiler remarked that if the scientific community forgets its agreement to trade indefinite operation of HST in order to start NGST, it won't get the latter. This deal was struck with the administration and OMB, and the astronomy community should keep its earlier agreement. 2010 is already a five-year extension for HST. If there is no overlap between HST and NGST, there is plenty of archive data from the HST to keep observers busy. Citing the estimate given during SScAC's discussion of the issue that retrieval would cost \$500 million, Dr. Sellgren asked if this money might better be used in other ways. Dr. Weiler stated that this estimate was inaccurate. The program would not have to pay for a shuttle mission. That would come from the shuttle budget, and furthermore the real cost of an extra launch is only between \$50 and \$100 million.

Third, Mars: Dr. Squyres noted SScAC's concerns with Mars Program plans for 2007 and beyond but explained that the committee was pleased with Mr. Figueroa's proposal to put together a MERT of senior program managers, scientists, etc., to conduct a one-a-year high-level review of the program. He then outlined the committee's discussion of MSL. He stated that SScAC strongly supported and encouraged the

goal of moving 1% to 2% of the budget into science as stated by Mr. Figueroa. Dr. Weiler stated that MSR is going to cost \$1 to \$2 billion, which is very expensive, and will require a lot of technology work. OSS does the best job it can on Mars with the money that OMB and the President allot. He assured SScAC that there would never be a situation where certain missions would be promised during times when the budget would not support them. It is a matter of management. There will be no promises that cannot be kept. Dr. Weiler stated that he wanted to alleviate any fears of such situations happening again. When the budget is received OSS will meet with the Mars community and decide the right thing to do. Dr. Squyres observed that there will be tough choices, and Dr. Weiler agreed. Dr. Squyres noted that the committee discussed the problem of division in the community and that Dr. Drake, chair of the SSES, had been given the task of articulating to the Agency what the community consensus is on the issue. Dr. McComas observed that at least some SScAC members were concerned based on the presentations they saw about 2002 launches and the clarity of decisions and optimization for success. The committee was told that at this point it is safer to go with two rovers than one and some were uncomfortable with the level of detail on that. Dr. Weiler shared the committee's concern. He noted that his initial perception had been: how can building two be safer than one? Through subsequent meetings, however, he has been convinced that we are not in a position now to say the best interest of the program is to eliminate one lander. This issue will be revisited to see what progress has been made. There are rational reasons for keeping both. At this stage, one lander is not delaying another. Referring to concerns with MSL, Dr. Beichman noted his belief that it is late to be making a decision about something that has to launch in 2007.

Dr. Squyres moved the discussion to the fourth topic, technology, expressing the committee's frustration at not being able to gain the insight it felt was necessary to help the Agency. He outlined the new approach whereby Directors were asked to give presentations and that these were by far the clearest, most concise and comprehensible technology presentations to date. SScAC was pleased with the level of competition. Dr. Squyres explained the concerns of the committee over coordination across divisions, the Enterprise, the Agency, and among various other agencies that do technology and noted the committee's desire to hear from the Office of Aerospace Technology about how that organization should interact with OSS. Dr. Weiler said he would appreciate any ideas on how to improve coordination. Dr. Sellgren noted the importance of showing how priorities are tied to the Strategic Plan.

Dr. Squyres raised the fifth topic, maintaining critical core capabilities at centers, and outlined SScAC's extensive discussion of the issue. He explained the committee's consensus on the need for core capability maintenance and the lack of consensus on how that should be achieved. Dr. Weiler stated that the only way he could think of to insure core competency is to make sure the engineers and scientists have interesting work, and the only way to do that is to guarantee at least one spacecraft to work on. He did not understand how this need could not be clear to those who agree with the need for core competency. Dr. Squyres asked that those opposed to Dr. Weiler's plan explain their views. Dr. Hathaway restated his earlier argument that if the centers have unique capabilities they should be able to win competitions and if not, a mission allocated to a center must either cost more than it needs to or involve technology that is "behind the curve." Dr. Weiler responded that he has canceled overpriced missions, and would do so again if they could not be managed well or use the best technology. Dr. McComas noted that everyone can stand behind the generic need, but not everyone could endorse Dr. Weiler's plan. Dr. Weiler noted other suggestions have been made, such as giving science and technology money that is neither competed nor peer reviewed, but he has refused to consider such an option. He asked for other ideas if consensus on how to achieve the goal could not be reached, a charge Dr. Squyres called fair. Dr. Weiler stated that we cannot have a national resource for people to go to if we do not keep people there, and we cannot do that unless they have interesting things to do. Dr. Squyres observed that the committee was about evenly split on the issue and stated that members opposed should suggest solutions they feel are better. Dr. Drake expressed concern that the committee's position might be misinterpreted by Dr. Weiler and noted that Dr. Weiler should not feel he does not have support on the issue from SScAC. Dr. McComas summarized the opposing view by saying some members were not persuaded by Dr. Weiler's plan, but that they do not have a better idea; therefore, if Dr. Weiler feels he needs to implement his plan in order to achieve the goal, that action would be justified. Dr. Weiler closed by observing that having everything competed would be the ideal situation and that if there were a Discovery AO every three months, keeping everyone busy would not be a problem.

Strategic Plan Update

Dr. Marc Allen explained the guidelines for the theme roadmapping reports. Uniformity in the reports is helpful because it allows easy comparison. There have also been unfounded concerns that report appearance could affect budget allocations, which would be eliminated if all reports were uniform. Input is needed from everyone, and material coming from subcommittees should be adhered to as closely as possible. Due to the crosscutting nature of astrobiology, it requires uniform treatment so that where there is representation of the same science in different places it does not look different. Though astrobiology contributions are quite different between themes, the science foundations overlap. Dr. Allen noted that there are varying opinions on issues such as task group input. If material from such groups is to be included it needs to be properly vetted. One key reason is there is a lot of pride in the transparency of the process. To save time, rather than present all the guidelines, Dr. Allen directed members to a handout explaining them. A handout on the approach to obtaining consistent astrobiology guidance was also provided. He reminded the committee that initiation of phase one activities is still on schedule for this month and that roadmapping results are due to Headquarters in September 2002.

Information Technology (IT) Security Update

Mr. Lee Holcomb, Chief Information Officer (CIO), provided an update on the status of the IT Security clause as well as the OMB mandate on data quality and how it effects publication of data.

The IT security clause was intended to respond to the increasing threat on Agency resources from cyber attacks. The number of possible attacks against the Agency is tracked and it has gone up by about 280% in the last year. The Agency and those who work with it, particularly if they have a "nasa.gov" address, are a growing target. The good news is that the infrastructure has gotten better. There are fewer successful compromises today despite increasing threats. The bad news is that compromises can be very destructive. One center was off line for two and a half weeks because of an incident. Certain aspects of the guideline are passed on to university contracts. The wording of the clause has been criticized as unclear and confusing, and there have also been complaints that it was not being applied uniformly. As a result, execution was suspended in March 2001 until the clause could be clarified. The clause was reissued in a revised state in July 2001. As of right now, about 80% of applicable contracts have been modified and the remaining 20% are being negotiated. The clarified guideline allows universities to screen employees if they wish to do so, or NASA offers the ability to screen. Only a small number of people such as those who work in a privileged access role are screened and only limited information is collected. Most contracts do not involve screening. The process of finalizing the new clause is underway. Dr. Squyres offered the committee's thanks for implementing the revisions. He called the work a great example of how NASA ought to respond and deal with the university community. Dr. Mewaldt asked what kind of issues are involved with contracts still being negotiated, and Mr. Holcomb answered that it was primarily questions regarding the scope of the clause and how applicable it is to a given contract.

Mr. Holcomb moved to the OMB mandate on data quality, which relates to growing concerns with data put out by several agencies. These concerns tend to focus on agencies such as the Environmental Protection Agency that are involved with issuing information about environmental situations that cause huge expenditures for cleanup or are potentially involved with letting problems go because they are not uncovered. The real problem is how to regulate this process and there are also concerns over the health of individuals who may get improper information. In general, the concern is with scientific research conducted by the federal government. Mr. Holcomb has worked with Dr. Kathie Olsen, NASA's Chief Scientist, to put together a reasonable policy to address the issue. The belief is that the peer review process is the best method by which to validate the quality of data and results. The idea is to piggyback on that process and make a formal statement on how information should be published. As long as information is peer reviewed, that should satisfy the requirement for quality control. If data is not peer reviewed, such as information going into an archive, it needs to go through some equivalent process. A working group was established to lay a framework for this. The scientific and technical information clause written into NASA contracts is also being modified to deal with this issue. For grants it is assumed the peer review process is used. In contracts a clause is being added and negotiations can proceed through one of three options. The first is to allow contractors to publish anything they want, or basically no clause at all. The second is that contractors can publish whatever preliminary data they want but a final report must be submitted to NASA for scientific and technical information review. The third is that contractors must comply with the

requirements for NASA review of publications, which mainly applies to large contracts with corporations that may involve sensitive or export control data and would probably not be used in a university contract. The clause is nearing completion. This system provides a lot of latitude. At most, universities would probably only be subjected to the final report requirement. Dr. Squyres observed that contracts he has been involved in seemed to meet the requirements as both raw data and scientific investigations were required to go through peer review. He then asked if SScAC could provide any assistance on this issue. Mr. Holcomb responded that input would be welcomed but he does not expect the issue to be a difficult one, particularly given that universities would essentially not be required to do anything that is not already being done. He did not anticipate completion of a policy before next spring. Dr. Squyres commended Mr. Holcomb for bringing the issue to the scientific community early in the process. Dr. McComas echoed this but described one potential problem. When building an instrument there can be sensitive aspects where formal review would be desired before publishing. Because a contract covers mission operations and analysis of the data that comes out of that instrument, it would be troublesome for the community if one had to go through any sort of review process other than the regular professional peer review to publish data. Dr. McComas was concerned that because flight contracts often cover both types of work they could end up imposing a more onerous requirement on elements where it was not intended. Responding to a question from Dr. Squyres, Dr. McComas answered that this issue might well be handled with proper contract wording, but that this concern should be considered while the new policy is being formulated. Mr. Holcomb stated that he was aware of that concern but felt it could be adequately addressed with contract language. He added that there is a policy that says when dealing with export data, export control review is required, but that in general the favored option is to rely on traditional peer review to fulfill this requirement. Dr. Squyres stated that there is a benefit in having archives and other materials not normally peer-reviewed go through that process as well. All investigators stand to benefit when that happens. Noting that in general, peer review is the solution to all the issues involved, Dr. Squyres said SScAC would be happy to review specific cases where issues arise. Dr. Mewaldt asked if peer review of final reports, yearly technical reports, etc. would be required. Mr. Holcomb answered that the discussion related only to the publication of results. Regarding contracts to build and deliver instruments, Dr. Squyres observed that in his experience PIs deliver investigations, not instruments. One committee member commented that while peer review and publication of journals is the norm now, people may in time not bother as much with journals because of the growing number of archives; therefore, peer review may not be the answer in five years. Dr. Squyres responded that the archive generation and validation process should be peer reviewed and that it would be unfortunate if interpretive work did not go through peer review as well. Dr. Richstone observed that large projects produce large volumes of data but that they do have to go through a review process and noted his concern that a whole new process should not be invented.

Dr. Margon stated that the committee's discussion should focus on avoiding the addition of new requirements for the community. The system works well now and more should not be added, yet the information presented led him to believe that new layers of peer review are forthcoming. Dr. Squyres agreed that it would be a serious mistake to put additional burdens on the community because the current system works. He observed that the issue is politically driven because people are concerned that environmental data are being used to drive public policy and that they are being twisted or perverted in some way by people with an agenda. Some areas in OSS may be affected, but Mars is not a problem. Dr. Margon stated that the real issue is not data quality but instead concern about data used to reach conclusions that will cause problems, regardless of their quality. He said SScAC should stress that the frontline response should be the existing peer review process and anything beyond that should be discussed.

GPRA Performance Assessment

Dr. Marc Allen led a discussion of the ratings and progress highlights for objectives in the GPRA Performance Assessment. For FY01 there were 14 performance objectives. Seven of them dealt with science and were to be assessed based on theme subcommittee input. The remaining seven did not involve scientific objectives and were not reviewed by subcommittees. Objectives are given a color-coded rating. Blue means progress was surprising above expectations, green means progress met general expectations, yellow means generally anticipated forward motion did not occur but some useful progress was made, and red means an area had a disappointing year. Dr. Allen suggested that the committee focus mainly on objectives rated blue as these receive more substantial scrutiny. Dr. Squyres observed that the NAC

focuses on objectives rated blue, yellow, or red with little discussion of those rated green. Dr. Allen reviewed the initial assessments and ratings assigned to objectives.

Regarding the operational objective of "Solve the Mysteries of the Universe" (#1S2), which received an initial blue rating, Dr. Allen noted success with Hubble and Chandra. Dr. Squyres asked how expectations were exceeded and Dr. Richstone stated that NASA had done an exemplary job on these missions. For the second blue rating, the development and operations objective of "The Search for Life Beyond Earth" (#1S14), Dr. Allen highlighted successes with such missions as the Mars Odyssey and particularly MGS as justification for the rating. The development objective of "Solve the Mysteries of the Universe" (#1S1) was rated yellow, but there is fear the NASA comptroller will want to downgrade this rating to red. The annual performance goal for that objective focused on the Galaxy Evolution Explorer (GALEX), the Microwave Anisotropy Probe (MAP), Gravity Probe-B (GP-B), and the Cooperative Astrophysics and Technology Satellite (CATSAT). Only MAP was launched. CATSAT was canceled for good reasons, but the system is designed in such a way that a correct decision is punished because it shows up in the review simply as an unmet goal. In general, some targets were achieved and some were not. Dr. Allen asked for the committee's opinion on whether the objective should be rated yellow or red. Dr. Margon suggested it remain yellow, to which there was general agreement. Dr. Squyres stated that given the successes and good management decisions involved, to rate the objective red would be incorrect. The committee discussed details of decisions made regarding missions within the objective. The objective of developing new technologies needed to carry out innovative and less costly mission and research concepts (#1S12) was rated yellow, but there was debate regarding whether it might warrant a green rating. Key indicators were Information Systems, High Performance Computing, Explorer Program Technology and Flight Validation, and the performance goal was to meet no fewer than 66% of the objectives within each of those indicators. Dr. Squyres characterized the first and third indicators as solid green, but High Performance Computing was canceled, and the Flight Validation goal was not met, therefore he felt the objective deserved an overall yellow rating. After a discussion of the performance goals used in the report, the committee concluded that the Performance Plan should be careful not to focus on low-value indicators. Dr. Squyres observed that SScAC had criticized OSS on this point in the past. Dr. McComas noted that he is a PI for one of the missions covered by the objective and he never saw the performance goals. Dr. Squyres stated a recommendation that OSS should be careful to ensure that goals are representative and that they are communicated to PIs. The committee discussed the issue of whether canceling something based on good reasons should count against a program. Overall, the committee did not feel it necessary to change any of the initial color ratings for the objectives, and Dr. Squyres noted that he was prepared to defend each of the ratings assigned to the seven non-science objectives.

The subcommittee chairs briefed the committee on the results of their respective discussions (earlier in the week) regarding ratings and assessments of research focus areas (RFAs) within the objectives that dealt with science. Dr. Dressler noted that the OS had only one item rated blue for RFA 12, "Discover planetary systems of other stars and their physical characteristics," which was based on such achievements as HST observations of a planet's transit across the face of the star HD 209458. Dr. Squyres felt this was an easily defended choice. Dr. Margon explained that SEUS had also awarded only one blue, for RFA 4, "Test the general theory of relativity near black holes and in the early Universe, and search for new physical laws using the universe as a laboratory." He highlighted HST observations that yielded strong evidence for dark energy as justification for the choice. Dr. McComas reported that SECAS gave two blue ratings. The first was for RFA 19, "Understand the origins of long and short-term solar variability." There were a number of important events in this area, most significantly work on the origins of the solar dynamo, which the committee discussed. Dr. McComas explained that for RFA 23, "Develop the capacity to predict space weather," SECAS decided to change the initial blue rating to green. Dr. Squyres felt both choices were defensible, but asked for explanation of why RFA 21, "Understand the space environment of the Earth and other planets," was rated blue. Dr. McComas highlighted research enabled by the Imager for Magnetopause-to-Aurora Global Exploration (IMAGE) mission, which allowed important advances in magnetospheric physics. Dr. Allen explained that while making initial ratings, if something that was unknown for a long time had been decisively settled, he recommended a blue rating. After further discussion, the committee accepted the blue rating for 21. Dr. Drake outlined SSES ranking decisions. RFA 12, "Inventory and characterize the remnants of the original material from which the Solar System formed," was an obvious blue based on achievements such as landing NEAR on Eros. Dr. Squyres noted

that he agreed with the rating, but he felt that while the Eros landing was a magnificent technical achievement, the additional science gained because of it was modest. RFA 13, "Learn why the planets in our Solar System are so different from each other," had been changed from green to blue based on Cassini's encounter with Jupiter, observations of a Mars dust storm and other successes. Dr. Squyres stated that he felt the item deserved a green rating for various reasons. For instance, the Jupiter flyby simply worked as it was supposed to and Mars dust observations were somewhat serendipitous and so not accomplished with the most favorable instruments. Nonetheless, he said that if SSES felt strongly that it was blue he would defend that rating at NAC. SScAC ultimately decided to change the rating to a very strong green. SSES changed RFA 17, "Chart the distribution of life-sustaining environments within our Solar System, and search for evidence of past and present life," from an initial blue rating to green. Dr. Drake outlined relevant accomplishments such as increasingly strong evidence of an ocean on Europa from Galileo flybys and research to show that meteorites have the potential to transport life. Dr. Squyres observed that assessments should be based not simply on new results that make front-page headlines, but the superb science that gets done when the community digs into data, which sometimes happens years later. Dr. Squyres supported the green rating because some of the accomplishments were continued interpretations of data first used in previous years, which Dr. Drake observed is one of the problems with reviewing science annually. RFA 24, "Find extraterrestrial resources and assess the suitability of Solar System locales for future human exploration," was the last item rated blue. Highlights included the discovery of layered deposits on Mars. Overall, SScAC accepted all subcommittee classifications, with the exception of RFA 13, which was downgraded from blue to green.

The final task was to use the relevant RFA ratings to determine a color rating for each of the objectives that dealt with science. The committee had an extended discussion of the difficulty of deciding how various results relevant to an objective should be weighted. With the exception of 1S3, which the committee decided to upgrade from yellow to green, the committee accepted all initial color ratings for the objectives. Dr. Macauley expressed thanks to Dr. Allen for his efforts. Dr. Allen noted that Ms. Jennifer Kearns had done most of the work. Dr. Squyres offered deep thanks to both of them from the committee. The committee discussed at length whether science was being properly evaluated through the GPRA performance assessment process. Dr. Squyres concluded that OSS needs to be careful about how it formulates its goals because there have been instances where a goal was formulated and then wound up not being achieved because a better way to accomplish the goal was found. There needs to be something in the process that allows credit for finding a better solution.

Closing Remarks

Dr. Squyres suggested that the SScAC's final letter be drafted later and edited through email correspondence among members, which the committee agreed to do. He then asked for final comments or concerns from members. Dr. Macauley stated that she had been honored to be a part of SScAC and that it is important to have non-space scientists such as herself involved with the committee. Because this was his last SScAC meeting as chair, members thanked Dr. Squyres for his service and commended him for his work. Dr. McComas expressed concern that the discussion of technology with Dr. Weiler may have given the appearance that earlier concerns had been resolved. He also felt the level of peer review for technology might have been inaccurately portrayed as sufficient. Dr. Squyres stated that Dr. McComas' concerns would be included in the committee's letter. Dr. Squyres said his job as chair had been made easy by the outstanding support received from Westover Consultants in setting up meetings. He commended Ms. Marian Norris, Dr. Allen and Ms. Carrie Sorrels for their work as well as Ms. Paula Frankel, whom he called a national treasure. In closing, he said his experiences as chair had been extremely rewarding. Dr. Allen presented him with parting gifts and the meeting was adjourned.

AGENDA**Space Science Advisory Committee**

December 5-6, 2001

Hilton Cocoa Beach Oceanfront

Sea Oats/Sawgrass Rooms

Wednesday, December 5

8:30	- 9:00	Announcements	S. Squyres
9:00	- 10:15	Associate Administrator's Report	E. Weiler
10:15	- 10:30	BREAK	
10:30	- 11:30	Division Reports	Division Managers
11:30	- 12:00	Mars Exploration Program	O. Figueroa
12:00	- 1:00	LUNCH	
1:00	- 1:15	In-Space Propulsion	C. Hartman
1:15	- 3:20	Technology Program Reports (25 minutes each)	G. Withbroe A. Kinney C. Hartman O. Figueroa H. Thronson
3:20	- 3:30	BREAK	
3:30	- 5:00	Subcommittee Reports	Subcommittee Chairs
5:00	- 6:00	Committee Discussion	S. Squyres
7:00		Committee Dinner at the Black Tulip	

Thursday, December 6

8:30	- 10:30	GPRA Performance Assessment	M. Allen Subcommittee chairs
10:30	- 10:45	BREAK	
10:45	- 12:00	Discussion with Associate Administrator	E. Weiler (telecon)
12:00	- 1:00	LUNCH	
1:00	- 1:45	IT Security	L. Holcomb (telecon)
		OMB Data Quality Guidelines	
1:45	- 2:15	Strategic Plan Update	M. Allen
2:15	- 3:00	Committee Discussion and Letter	S. Squyres
3:00	- 3:15	BREAK	
3:15	- 5:30	Committee Discussion and Letter	S. Squyres

SPACE SCIENCE ADVISORY COMMITTEE
Membership List

Steven W. Squyres (Chair)
Cornell University

David L. Akin
University of Maryland

Charles A. Beichman
NASA/Jet Propulsion Laboratory

Alok Das
Air Force Research Laboratory/VSC

Michael J. Drake
University of Arizona

Alan M. Dressler
Carnegie Observatories

Jack D. Farmer
Arizona State University

David H. Hathaway
NASA/Marshall Space Flight Center

Roderick A. Heelis
University of Texas at Dallas

Paul H. Knappenberger
Adler Planetarium and Astronomy Museum

Edward W. Kolb
Fermi National Accelerator Laboratory

Molly K. Macauley
Resources for the Future

Bruce H. Margon
Space Telescope Science Institute

David J. McComas
Southwest Research Institute

Richard A. Mewaldt
California Institute of Technology

James J. Papike
University of New Mexico

Douglas O. Richstone
University of Michigan

Kristen Sellgren
Ohio State University

William Smith
Universities for Research in Astronomy

Maria T. Zuber
Massachusetts Institute of Technology

Marc S. Allen (Executive Secretary)
NASA Headquarters

SPACE SCIENCE ADVISORY COMMITTEE (SScAC)**Cocoa Beach, FL****December 5-6, 2001****MEETING ATTENDEES***Committee Members:*

Squyres, Steven W. (Chair)
Akin, David L.
Allen, Marc (Executive Secretary)
Beichman, Charles A.
Drake, Michael J.
Dressler, Alan M.
Hathaway, David H.
Heelis, Roderick
Knappenberger, Paul H.
Kolb, Edward W.
Macauley, Molly K.
Margon, Bruce H.
McComas, David J.
Mewaldt, Richard
Pipike, James J.
Richstone, Douglas O.
Sellgren, Kristen

Cornell University
University of Maryland
NASA Headquarters
NASA/JPL
University of Arizona
Carnegie Observatories
NASA/MSFC
University of Texas at Dallas
Adler Planetarium and Astronomy Museum
Fermi National Accelerator Laboratory
Resources for the Future
Space Telescope Science Institute
Southwest Research Institute
California Institute of Technology
University of New Mexico
University of Michigan
Ohio State University

NASA Attendees:

Allamandola, Lou
Bergstralh, Jay
Calabrese, Mike
Capps, Rich
Crane, Philippe
Cuzzi, Jeff
Devirian, Mike
Figueroa, Orlando
Hartman, Colleen
Hasan, Hashima
Hertz, Paul
Howard, Rick
Hubbard, Scott
Kinney, Anne
Norris, Marian
Oegerle, Bill
Pilcher, Carl
Reekorst, Sandy
Rummel, John D.
Sadof, Donna Walls
Sakimoto, Phil
Six, Frank
Sorrels, Carrie
Thronson, Harley
Unwin, Stephen
Varsi, L.
Weiler, Ed
White, Rich
Withbroe, George

NASA/ARC
NASA Headquarters
NASA/GSFC
NASA/JPL
NASA Headquarters
NASA/ARC
NASA/JPL
NASA Headquarters
NASA Headquarters
NASA Headquarters
NASA Headquarters
NASA Headquarters
NASA/ARC
NASA Headquarters
NASA Headquarters
NASA/GSFC
NASA Headquarters
NASA/GRC
NASA Headquarters
NASA/GSFC
NASA Headquarters
NASA/MSFC
NASA Headquarters
NASA Headquarters
NASA/JPL
NASA/JPL
NASA Headquarters
NASA/GSFC
NASA Headquarters

Other Attendees:

Blaes, Omer
Cattell, Cynthia
Cominsley, Lynn
DiBiasi, Lamont
Flanagan, Kathryn
Gloeckler, George
Hinnners, Noel
Kahler, Steve
Klimchuk, Jim
Klumpar, Dave
Larkin, James
Peterson, Bradley
Price, Steve
Purdy, William, Jr.
Reese, Terry

University of California, Santa Barbara
University of Minnesota
SSU
L. DiBiasi Assoc.
Massachusetts Institute of Technology
University of Maryland
Lockheed Martin
AFRL
NRL
Montana State University
University of California, Los Angeles
Ohio State
Lockheed Martin
Ball Aerospace
Lockheed Martin

**SPACE SCIENCE ADVISORY COMMITTEE (SScAC)
Cocoa Beach, FL
December 5-6, 2001**

RECOMMENDATIONS

January 12, 2002

Dr. Ed Weiler
Associate Administrator for Space Science
NASA Headquarters
Washington, DC 20546

Dear Ed:

The Space Science Advisory Committee (SScAC) met in Cocoa Beach on December 5-6, 2001. This letter summarizes the findings and recommendations from our meeting.

I would like to begin our remarks by offering SScAC's warmest wishes to George Withbroe, who will be retiring from NASA at the end of January. George has provided truly visionary leadership to the Sun-Earth Connection Theme over a full solar cycle (1991-2002). Under his thoughtful and caring guidance, Sun-Earth Connections emerged from a portfolio of separate and sometimes divergent sub-fields into the robust, broad-based program that it is today. He essentially invented, almost single-handedly sold, and led the early development of the Living With a Star program. George's dedicated contributions to the SEC Theme and to NASA's overall space science program will be sorely missed. On behalf of the entire space science community, we express our deepest thanks to George, and we wish him all the best in his life after NASA.

Code S Technology Program

One of the highlights of our meeting was a content-rich series of presentations on technology development within Code S. We greatly appreciated these presentations, and the clarity that they helped to bring to our understanding of this very important topic.

Based on the presentations we heard, we understand that each division acts largely autonomously to plan and execute technology development programs for their missions. Although there are a number of areas where no support currently exists for needed development, by and large it appears that technology development within the divisions is well understood. Indeed, we received glimpses of a number of exciting and important technology development programs currently underway.

Our primary concern is that coordination of technology development among divisions, across enterprises, or outside of NASA appears to be ineffective. A number of technologies appear in the critical paths of most or all of the divisions, but we saw little coordination among separate and parallel development programs. Similarly, technology areas under development in Code S programs (such as automatic rendezvous) parallel efforts underway in other federal and in international organizations; it is not clear how much coordination is taking place in these complementary efforts.

Of particular concern is the fact that there is no apparent connection between Space Science technology needs and the work being performed under the considerable resources of Code R. The way Code R chooses technology topics was described to us as being done in an "unpredictable, erratic, uncoordinated, and not particularly useful way." A number of high return space science technology areas, currently at low TRL, could and should be beneficially and logically supported by Code R.

As an outcome of the apparently limited coordination among divisions, we have concerns about the process within OSS by which enterprise-wide technology priorities are set, and the consistency with which technology development decisions are related to the needs of the strategic plan. We were also concerned to

hear of development programs that have been interrupted by loss of funding or by unilateral decisions of Code R to redirect co-funding. It is critical that development initiatives that continue to make good technical progress be protected from the vagaries of the budget to the greatest extent possible.

As technology programs progress to higher TRLs, it is essential to take them through flight demonstrations to make them "eligible" for inclusion in flight programs. The only current path for this to occur is the New Millennium program, which is limited in flight opportunities and is based on a small set of technologies. The method used to select this limited set of technologies was only presented in a cursory and informal way, and it was not clear to us that the New Millennium technology decision process is properly aligned with the priorities of the Code S strategic plan. This topic could perhaps be addressed at a future SScAC meeting.

Code S R&A funding is openly competed in an exemplary way, and produces significant technology as well as science. However, we also note that Code S has a less exemplary record for open competition in much of its technology development outside of R&A. For example, it was noted that a four-year hiatus has taken place since the last NASA research announcement addressing generic OSS-relevant technology development. It is essential for the health of the technology development community that regular opportunities exist for openly competed research support.

In summary, given the lack of evident coordination across OSS divisions, among enterprises, and with the outside community, we remain concerned about whether or not OSS (and, indeed, NASA) is pursuing the best portfolio of new innovation and appropriate evolutionary technology development for near- and long-term Space Science objectives. We would find it useful at a future meeting for Code R to brief us on their technology development program, and how it supports the needs of the Code S strategic plan.

Mars Exploration Program

Mars Exploration Program Director Orlando Figueroa briefed us on the current state of the Mars Program. He told us that he will interact with two key groups: the Mars Exploration Program Assessment Group (MEPAG), and the new Mars Exploration Review Team (MERT). These two groups and Orlando's plan for interacting with them are fully responsive to our past recommendations on this issue. We also noted with approval the establishment of a Mars Fundamental Research and Analysis Program with a planned goal to increase its funding to about 2% of the Mars Exploration Program budget.

Concerning the missions in the 2001-2005 timeframe, most of our discussion dealt with the 2003 Mars Exploration Rover mission. Because of my involvement in that mission, Mike Drake chaired that portion of our meeting, and authored the comment below:

"Considerable concern was expressed about the critical decisions that need to be made over the next few months. During the discussion Orlando Figueroa reviewed some of the decision points and pointed to examples of the metrics he would use to make decisions to delay one or both landers, cancel a lander, etc. He argued that the decision making process was complex and that premature decisions should not be made. The SScAC remains concerned that this complex mission remains challenging in most of its aspects."

After 2005, the direction of the Mars program becomes less clear. We note with concern that there appears to be a growing division within the Mars community between scientists seeking early Mars Sample Return and those who believe it is best to delay it. MSR is currently scheduled to begin with an FY'11 launch, but schedule pressures and other issues could force it to a later date. A decision concerning the nature of the '07 Mars Smart Lander mission will follow logically from the extent to which it functions as a near-term enabling mission for MSR. We believe that removal of the uncertainty over when Mars Sample Return will occur will help reunite the Mars community and provide focused support for Mars exploration. We directed the SSES to discuss the Mars Program at its February 2002 meeting and to report to SScAC in March.

A technology program for Mars is critical to enabling future Mars missions. In order to assure appropriate program content, all participants in Mars exploration must have some say in its definition. We recommend that all stakeholders in the Mars Exploration Program, including JPL, NASA-ARC, NASA-JSC, PIs on Scout missions, and advisory groups for sample curation, participate in recommending Mars technology priorities to NASA HQ.

In-Space Propulsion

Colleen Hartman briefed us on Code S's efforts to develop a significant In-Space Propulsion (ISP) capability. ISP is of enormous interest to several future missions in both the Solar System Exploration and Sun-Earth Connection themes. At our most recent meeting, we recommended that ISP priorities be established with inputs from all the Code S themes, with the aim of benefiting all the themes. Colleen described the current priorities for ISP technology studies after her FY02 budget was cut from \$32M to \$19M by a congressional earmark. Four technologies (Aerocapture, Next Generation Ion Thrusters, Nuclear Electric Propulsion, and Solar Sails) are judged to be of highest priority and will be funded by an NRA to be released in January. We were very pleased to see Solar Sails - the highest priority ISP technology for the Sun-Earth Connection Theme - given equal priority to the technologies highly prized by the Solar System Exploration Theme. We take this as evidence of an appropriately balanced approach to developing ISP technologies, and we commend Code S for it.

Information Security and Data Quality

Lee Holcomb, NASA's Chief Information Officer, joined us via teleconference and briefed us on the status of the Information Technology (IT) Security Clause, and on upcoming issues related to data quality guidelines.

Lee reported that since the revised Information Security guidelines have gone into effect, 80% of the contracts affected by these guidelines have now been signed. We are grateful to him for working with the universities and other organizations to implement these guidelines in a fair and effective manner.

We also heard from Lee about new guidelines that are under consideration for the purpose of ensuring the quality of data products resulting from NASA-funded contracts. In the course of this discussion it was pointed out that the space science community already has in place a peer review system that has proven to be very successful in ensuring the quality of scientific publications. We suggest that this system can serve as a model for new efforts to ensure NASA data quality, and that no further actions are needed to assure the quality of data from OSS missions. We also endorse the suggestion that a draft of new guidelines in this area, if any, could be brought to the SScAC for comment. In addition, we strongly urge that if any new data quality guidelines are produced, they be adequately publicized within the scientific community before they are implemented so that investigators that are affected have sufficient opportunity to comment.

SOMO/CSOC

We heard briefly from Guenter Riegler about recent developments concerning SOMO and CSOC. Despite the financial impacts, we were very glad to hear that the portion of CSOC that is of relevance to Code S will now be managed by Code S.

Government Performance and Results Act

As we have done at past meetings, we helped assess the extent to which Code S has met its GPRA-related goals in the past fiscal year. Our scores have been reported separately to the NASA Advisory Council, and I will not repeat them here. But there are two points worth making. One is that it was a very good year for Space Science! The other is that Code S is extraordinarily well served in its substantial GPRA-related work by the efforts of Marc Allen and, especially, Jennifer Kearns.

Core Competence at JPL and NASA Centers

Finally, we had a long discussion of the importance of maintaining unique capabilities at the two key Code S field centers, JPL and Goddard. We strongly support the idea of maintaining such capabilities, since they are crucial to the nation's space science program. In particular, we note the important role of these centers in supplying basic capabilities to the science community in support of small teams and universities that would not otherwise have access to such capabilities.

Much of the maintenance of core capabilities at the field centers comes about as a consequence of the centers' successes in the competitive peer review process. As we have done in the past, we applaud Code S for the large fraction of its program that is openly competed.

Where we were unable to reach a consensus was on the best way of assuring maintenance of these capabilities. Some of us felt that peer review and competition is the best way to award all missions, including all missions to the field centers. Others among us felt that there is considerable merit in having Code S direct a small number of the most technically challenging missions to the field centers to help them maintain their cutting-edge capabilities. This may be a productive topic for future deliberations within SScAC.

To end this letter on a personal note, Ed, our meeting on Cocoa Beach was my last one as SScAC Chair. It has been a privilege and a pleasure to be able to serve NASA in this role for the last three years, and I thank you for the opportunity. I am delighted that you have chosen Andy Christensen as the next SScAC Chair. I know I am leaving the committee in good hands!

Best wishes,

Steve Squyres
Chair, SScAC

cc: SScAC
M. Allen
J. Alexander
O. Figueroa
G. Withbroe
C. Hartman
A. Kinney
H. Thronson
A. Christensen
J. Kearns

**SPACE SCIENCE ADVISORY COMMITTEE (SScAC)
Cocoa Beach, FL
December 5-6, 2001**

LIST OF PRESENTATION MATERIAL¹

- 1) Presentation to the Space Science Advisory Committee and Subcommittees [Weiler]
- 2) Mars Exploration Program [Figueroa]
- 3) OSS Resources Containing Technology [Kinney]
- 4) Integrated Technology Planning for the Solar System Exploration Program [Hartman]
- 5) Mars Exploration Technology Program [Figueroa]
- 6) Coordinating OSS Advanced Technology [Thronson]

¹ Presentation and other materials distributed at the meeting are on file at NASA Headquarters, Code S, Washington, DC 20546.